Grand Canyon NP GRI Workshop *June 26, 2001*

SUMMARY

A Geologic Resources Inventory (GRI) workshop was held for Grand Canyon National Park (GRCA) on June 26, 2001. The purpose was to view and discuss the park's geologic resources, to address the status of geologic mapping for compiling both paper and digital maps, and to assess resource management issues and needs. Cooperators from the NPS Geologic Resources Division (GRD), Natural Resources Information Division (NRID), GRCA, and the United States Geological Survey (USGS) were present for the workshop.

This involved a half-day field trip to various overlooks along the south rim, as well as another full-day scoping session to present overviews of the NPS Inventory and Monitoring (I&M) program, the GRD, and the on-going GRI. Round table discussions involving geologic issues for GRCA included the status of geologic mapping efforts, interpretation, paleontologic resources, sources of available data, and action items generated from this meeting.

Appendix A contains a list of attendees for the scoping session.
Appendix B contains an index to both the 1:24,000 and 1:100,000 scale quadrangles of interest to GRCA.

OVERVIEW OF GEOLOGIC RESOURCES INVENTORY (GRI)

The NPS GRI has the following goals:

1. to assemble a bibliography of associated geological resources for NPS units with significant natural resources ("GRBIB") to compile and evaluate a list of existing geologic maps for each unit,

2. to conduct a scoping session for each park,

3. to develop digital geologic map products, and

4. to complete a geological report that synthesizes much of the existing geologic knowledge about each park.

It is stressed that the emphasis of the inventory is ***not*** to routinely initiate new geologic mapping projects, but to aggregate existing "baseline" information and identify where serious geologic data needs and issues exist in the National Park System. In cases where map coverage is nearly complete (ex. 4 of 5 quadrangles for Park "X") or maps simply do not exist, then funding may be available for geologic mapping.

After introductions by the participants, Tim Connors (NPS-GRD) presented overviews of the Geologic Resources Division, the NPS I&M Program, the status of the natural resource inventories, and the GRI in particular.

He also presented a demonstration of some of the main features of the digital geologic database for the Black Canyon of the Gunnison NP and Curecanti NRA in Colorado.

This has become the prototype for the NPS digital geologic map model as it reproduces all aspects of a paper map (i.e. it incorporates the map notes, cross sections, legend etc.) with the added benefit of being geospatially referenced. It is displayed in ESRI ArcView shape files and features a built-in Microsoft Windows help file system to identify the map units. It can also display scanned JPG or GIF images of the geologic cross sections supplied with the paper "analog" map. Geologic cross section lines (ex. A-A') are subsequently digitized as a line coverage and are hyperlinks to the scanned images.

Tim further demonstrated the developing NPS Theme Manager for adding GIS coverage's into projects "on-the-fly". With this functional browser, numerous NPS themes can be added to an ArcView project with relative ease. Such themes might include geology, paleontology, hypsography (topographic contours), vegetation, soils, etc.

GRBIB

At the scoping session, individual Microsoft Word Documents of Geologic Bibliographies for GRCA were distributed.

The sources for this compiled information are as follows:

- AGI (American Geological Institute) GeoRef
- USGS GeoIndex
- ProCite information taken from specific park libraries

These bibliographic compilations were then validated by GRI staff to eliminate problems such as duplicate citations and typographical errors, and to check for applicability to the specific park. After validation, they become part of a Microsoft Access database parsed into columns based on park, author, year of publication, title, publisher, publication number, and a miscellaneous column for notes.

From the Access database, they are exported as Microsoft Word Documents for easier readability, and eventually turned into PDF documents. They are then posted to the GRI website at: http://www2.nature.nps.gov/grd/geology/gri/products/geobib/ for general viewing.

Also of note is that there is a comprehensive bibliography for Grand Canyon hosted by the Grand Canyon Association at http://www.grandcanyonbiblio.org/ . This site is maintained by Earle Spamer who is in Philadelphia.

EXISTING GEOLOGIC MAPS

After the bibliographies were assembled, a separate search was made for any existing surficial and bedrock geologic maps for the GRCA. The bounding coordinates for each map were noted and entered into a GIS to assemble an index geologic map. Separate coverage's were developed based on scales (*1:24,000, 1:100,000*, etc.) available for the specific park. Numerous geologic maps at varying scales and vintages cover the

area. Index maps were distributed to each workshop participant during the scoping session. Both GRI staff and the USGS produced separate handouts of the available geologic maps for the Grand Canyon area which were distributed to scoping session attendees.

GEOLOGIC MAPPING

Status of Mapping and Digitizing

George Billingsley and the USGS have been mapping in the Grand Canyon region for some time. They have been doing large-scale mapping (~1:24,000 scale) and then compiling this quadrangle data on to the 1:100,000 scale sheets (each 100k sheet comprises 32 quadrangles). The following 100,000 scale sheets are of interest to the Grand Canyon area (from northwest to southeast): Littlefield, Fredonia, Glen Canyon Dam, Mount Trumbull, Grand Canyon, Tuba City, Peach Springs, Valle, and Cameron. (see Appendix B for a graphical presentation of these sheets in relation to the individual 24,000 and 100,000 scale quadrangles).

To date, here is the status of each 100,000 scale sheet with regards to geologic mapping and digitizing:

100k Sheet	Geology mapped	Geology digitized	Notes
Littlefield	Yes; entire sheet	Yes	Does not incorporate any quadrangles of interest to GRCA; published as I-2628
Fredonia	only 1 of 8 quads of interest is mapped at 24 k scale (Heaton Nolls NW)	no	8 GRCA quads of interest, although none in park proper;
Glen Canyon Dam	5 of 8 mapped at 24k scale		8 GRCA quads of interest; Lees Ferry will be digitized as part of GLCA project
Mount Trumbull	Yes; entire sheet	In press	20 GRCA quads of interest
Grand Canyon	Yes; entire sheet	Yes	32 GRCA quads of interest; published and available at http://greenwood.cr.usgs.gov/pub/i-maps/i-2688/
Tuba City	Some captured on GRCA 62,500 geologic map	Some digitized by GRCA, but base is bad	10 GRCA quads of interest; no immediate plans by USGS to do it; John Rihs would like the 10 quads done at 24k
Peach Springs	Yes	No, but ready to be digitized either by USGS or NPS depending on funding	17 GRCA quads of interest; Tracey Felger feels it should be digitized next and in Flagstaff so George can oversee. Would probably be 22k at GS-5 for year to digitize; USGS will work to get an estimate; needs follow-up ; would fill large data void for GRCA digital geology
Valle	Mapping in progress over 3 years	Digitizing simultaneously with mapping over 3 years	2 GRCA quads of interest, but entire sheet is of high interest to John Rihs for water issues; USGS looking for additional funding for this project
Cameron	19 of 32 quads mapped; rest unmapped	Nothing digital	3 GRCA quads of interest are mapped (USGS I-1644; 62,500 scale), but is of high interest to John Rihs for water issues; Grandview Point, Grandview Point NE, Hellhole Bend; John would like to add more quads east and south of the Cameron 100k sheet; should

100k Sheet	Geology mapped	Geology digitized	Notes
			contact IM folks about getting them added in to quads of interest for park

Thus, complete digital coverage exists for the Littlefield, Grand Canyon and Mount Trumbull (in press) 100k sheets. The Peach Springs 100k sheet is ready to be digitized, but funding needs to be obtained by the USGS to do this in house.

Additionally, Tracey Felger mentioned that the Eastern GRCA map (Billingsley, 1986, published by the Grand Canyon Association) was digitized by a contractor but that it doesn't match the topography well at all because base map is poor. This paper version is still being sold in the Visitor Center.

USGS Surficial geologist Richard Hereford has very refined surficial mapping in places that is digital according to Debra Block, and should try to be acquired by the NPS.

There was some disagreement over prioritizing what should be done next in terms of GRCA geologic mapping. Tracey Felger thought that it would be logical to digitize the Peach Springs 100k sheet since the geology is already mapped and only needs to be converted to digital format. This would also fill a large data cap for the GRCA GIS.

John Rihs has different priorities in terms of delineating water resources for GRCA and would like to see (in order) the Valle 100k sheet completed, the GRCA quadrangles of interest on the Cameron and Tuba City 100k sheets, as well as some additional quadrangles that cover the Coconino Plateau. Additionally, John would like to see geophysical studies conducted in the Tusayan area as it relates to water issues.

However, it seems like a good idea to get the Peach Springs converted to digital since all of the quadrangles have been mapped already and only need converted to digital. GRI staff will work with the USGS to determine the best way to get this accomplished.

Other desired GIS datasets for GRCA

Soils

According to Pete Biggam (GRD Soil Scientist) the GRCA Soil Survey is in Progress with scheduled Completion for Late Summer-Fall 2001, with subsequent digitizing in FY-2002.

Caves and Karst

John Rihs is working on a cave management plan for GRCA, but must work with the Navajo Nation on this because of cultural issues and NAGPRA (Native American Grave Protection and Repatriation Act). He estimates some 3000 caves in GRCA. The Quaternary geology is a new frontier here and needs much more research. Caves cannot be opened up to research until they are inventoried, and the NPS must have tribal consultation too with regards to the caves.

Paleontology

Della Snyder (GRCA) would like a paleontological inventory beginning with the Neogene units and has talked to Greg McDonald (GRD Paleontologist) about this project. She would like to see a SEPAS proposal for a Quaternary inventory to serve as a startup for the rest of the geologic formations present at GRCA.

John Rihs also mentioned that he feels paleontological resources at GRCA are slowly disappearing and this may become a major resource management issue. He believes the combination of erosion and visitors are causing the decline in this resource.

Geologic Report

There are several good introductory texts that will likely serve as a primer for the geologic report that the GRI will produce. Among these are Greer Price's and Michael Collier's individual "Introductions to Grand Canyon Geology".

In addition, the proceedings from the 2000 Grand Canyon Symposium are likely to be out in the very near future. This volume is being edited by Dick Young and the Grand Canyon Association.

GEOLOGIC RESEARCH

Della Snyder heads up the research permitting process at GRCA from Flagstaff, AZ, so any research conducted in the park should be going through her office.

It was suggested that GRCA have a website for researchers to access to see what types of research the park is looking to have done and how to go about it. It was mentioned that the NPS currently has improved the Investigator's Annual Reports system on-line, and that might be of use. The address is:
http://science.nature.nps.gov/Research

OTHER MISCELLANEOUS ITEMS

- According to John Rihs he would like to see GRCA develop a General Management Plan (GMP) for geologic resources to spell out the various issues including caves and paleontology. Also, the park GMP needs updated to reflect new geologic hazards and paleontology specifically.

- Allyson Mathis would like to get a better consensus on what the timing for Grand Canyon carving is to give in interpretive talks. Hopefully the Grand Canyon 2000 Symposium proceedings will be able to give the desired answers to some of these issues. George Billingsley believes that interpreters may be giving outdated information to the public on this topic as well. There was also some concern that GRCA Interpretation and the Science Center may not be working as closely as they could. Much of this may be a result of the void in a natural resource liaison position that hasn't been filled since Tom Pittenger left.

- Geologic Hazards are numerous in GRCA, especially along the river from rock falls, debris flows, floods, and rock falls on camp sites. Also, there are potential hazards associated with asbestos deposits in the park. George mentioned that the Grand

Canyon Monitoring Research Center is part of USGS-BRD and they monitor the debris flows at GRCA.

- The water pipeline is constantly being repaired from rock falls and such and millions are spent each year on it.

- Their exists a potential for volcanism in western GRCA as it last erupted 1000 years ago

- Disturbed lands including uranium mines, like the Orphan mine need remediation and funding to do it. There are groundwater issues associated with the mine as well.

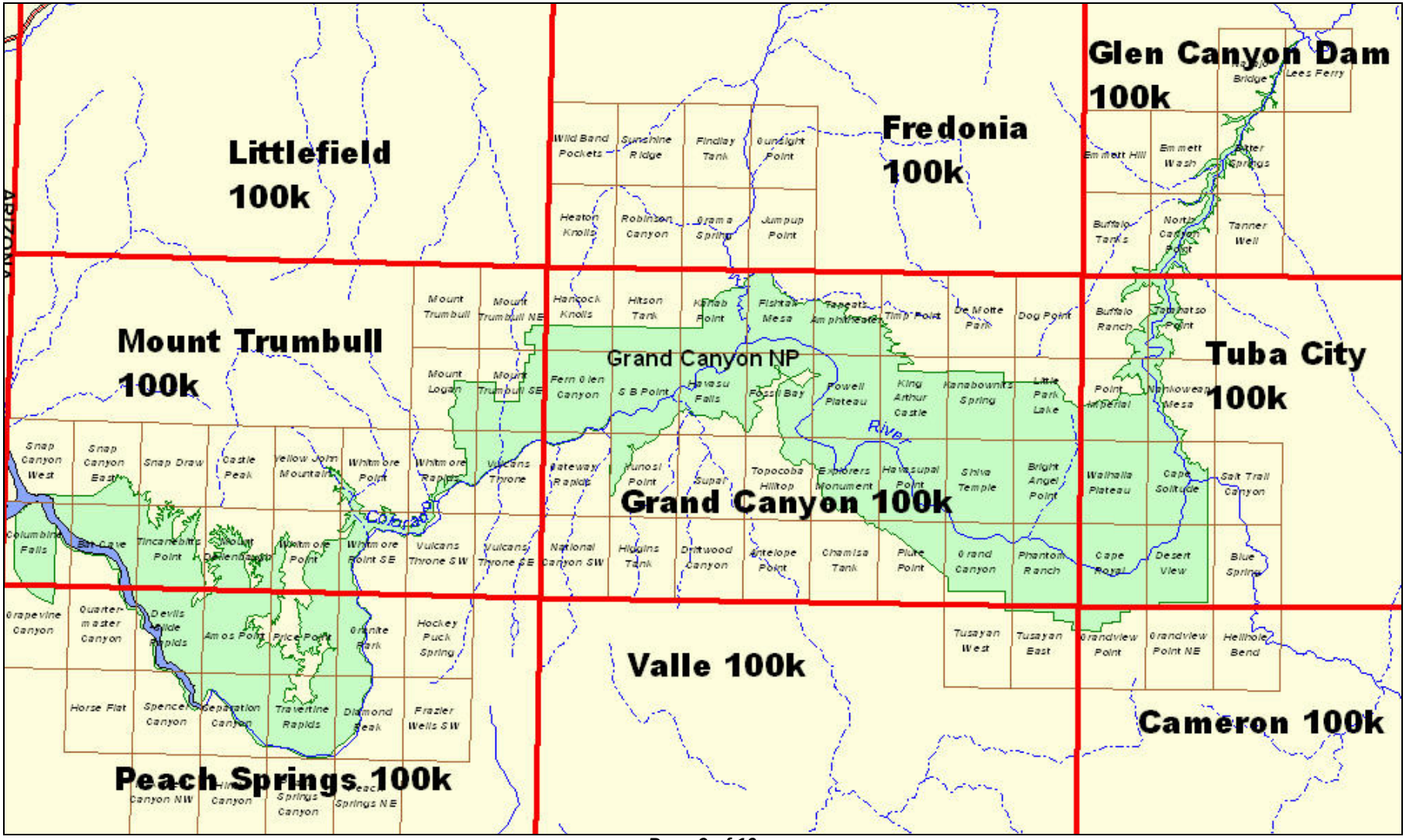
- There are very real external hazards to the park relating to water development as well.

- George Billingsley has found a connection between a cactus and certain geologic material (Qva) and enjoys learning more about the soil-rock-vegetation interaction and how GIS can be used to predict such relationships.

Appendix A: List of attendees for Grand Canyon NP GRI Workshop *June 26, 2001*

NAME	*AFFILIATION*	*PHONE*	*E-MAIL*	Grand Canyon 6-26
John Graham	Colorado State University	970-225-6333	Jpgraham250@msn.com	X
Tim Connors	NPS, GRD	303-969-2093	Tim_connors@nps.gov	X
Sherrie Landon	NAVA	307-755-1336	Slandon@uwyo.edu	X
George Billingsley	USGS	928-556-7198	Gbillingsley@usgs.gov	X
Della Snyder	NPS, GRCA	928-226-0163	Della_snyder@nps.gov	X
Allyson Mathis	NPS, GRCA Interpretation	520-638-7955	Allyson_mathis@nps.gov	X
Debra Block	USGS	928-556-7138	Dblock@usgs.gov	X
Jessica Wellmeyer	USGS	928-556-7267	Jwellmeyer@hotmail.com	X
John Rihs	NPS, GRCA Hydrologist	520-638-7905	John_rihs@nps.gov	X
Scott Graham	USGS	928-556-7270	Sgraham@usgs.gov	X
Tracey Felger	NPS, GRCA GIS	520-556-7164	Tracey_felger@nps.gov	X

Appendix B: Index to GRCA Quadrangles of Interest
(24,000 and 100,000 scale)



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